ECE 344L Microprocessors
## Test 2

Name: _Abeer Jihad_

100 Points MAX

15 Points

1. List the characteristics of a full-duplex, synchronous, serial communication channel. Also, list the minimal set of signal lines that will be needed to connect communicating devices which are configured with these characteristics.

Full duplex: Its mean we can communicate by two direction. So the recieved data and Transmited data can be Processing at the some time.

Synchronous / Generate a separate clock for the communication channel or the sys

Set of signal lines are
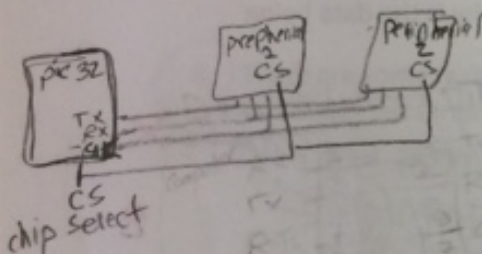
- Ground
- Rx (Recieve Signal)
- Tx (Transmite Signal).
- Clk (clock or counter)

5 Points

2. Which peripheral on the PIC32MX460F512L would we use if we need to implement an asynchronous serial communication channel? UART (universal Asynchronous Reciever & Transmite)

10 Points

3. You are debugging a PIC32 program and are examining values of 32 bit operands in memory. You examine one location and the value is 0x80000003. What are the two decimal equivalents of this hexadecimal value if the operand is an unsigned integer or a signed integer?
(Hint: 2^{31} = 2,147,483,648)

0x80000003 = 2,147,483,651 ✓

MAX VALUES

1000 0000 0000 0000 0000 0000 0000 0011₂

unsigned $(2^w - 1)$

+ signed $2^{w-1} - 1$

- signed -2^{w-1}

unsigned $2^{31} - 1 = 2,147,483,647$

+ signed $2^{31-1} - 1 = 1073741823$

$-2^{31} + 2^1 + 2^0 = -1073741821$ (off by 2^{31})

+2+2

7

4. You have configured the UART on your PIC32 microcontroller to communicate at 2400 baud using an 8,1,N configuration. The terminal to which you are connected is transmitting signals to your microcontroller, but the data are not received properly so you instrument the connection with the oscilloscope and observe the following signal, where each tick on the line corresponds to one bit time:

stop time ✓

start   0 1 1   0 0 1 0 1 0 0   1 1
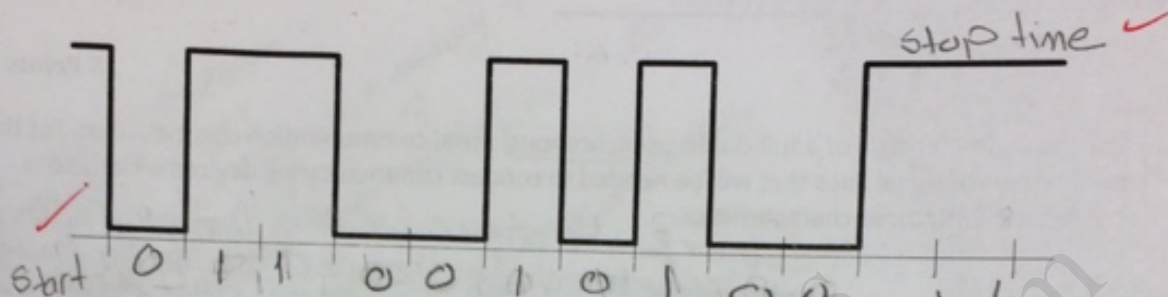
You measure the bit time and it corresponds to a 2400 baud rate. So, why is the data being received erroneously?

The data being received erroneously because may be some mis connect hardware components ✗ or may be the UART (SENDING) did not configure in proper way that make the data received erronecsly.

8

5. What is the one action which must be done by an interrupt service routine so that interrupts can continue to be processed after the first instance of an interrupt condition?   **5 Points**

If we want use the interrupt we have to enabl it then we have to clear the interrupt ✓ flag inorder to continue to be processed after the first instance of interrup condition.

5

6. You are examining a byte of data received from the UART, which is configured in an 8,1,N configuration. You are processing the received data as ASCII characters. The byte received by the UART has the following value: 10110011. Is this a valid ASCII character? Why, or why not?

4

$2^7 + 2^5 + 2^4 + 2^1 + 2^0$
$= 179$
$0..127$!

10110011
10 (110011 6 bit)

10 xxxxxx

it's valid ASCII character because the decimal value located in the range of the unicode table.

No   MSB = 1

7. Briefly describe what is needed to use interrupts on the PIC microcontroller. (Hint: there are three basic requirements)   **15 Points**

11

① Set the interrupt source ← *... all part of*
② Set the priority ——→ *part of the process*
③ Enable the interrupt and set the interrupt flag ←
   clear

an ISR   *clear*

8. There are some restrictions that apply when we are implementing Interrupt Service Routines. List three of these restrictions.   **15 Points**

15

1. We can't pass parameter to ISR ✓
2. The interrupt service Routines can't return any values. ✓
3. The interrupt service Routines can't called by any function. ✓
4. Ideally, the IRS does not call any function. ←

9. Check the boxes which indicate the possible configurations of each of the following serial communication interfaces.   **5 Points**

4

Serial Interface Type	Point-to-Point	Multiple Devices – Bus Configuration
UART / RS-232	✓	✗
SPI	✓	✓
I²C	✓	✓

10. We say that the MIPS processor is a Load/Store Architecture. Explain what this **10 Points**
means.

MIPS processor is load the data from
memory to register to do th arithmetic on them,
then we can put them back into the
memory by store them. ✓   10

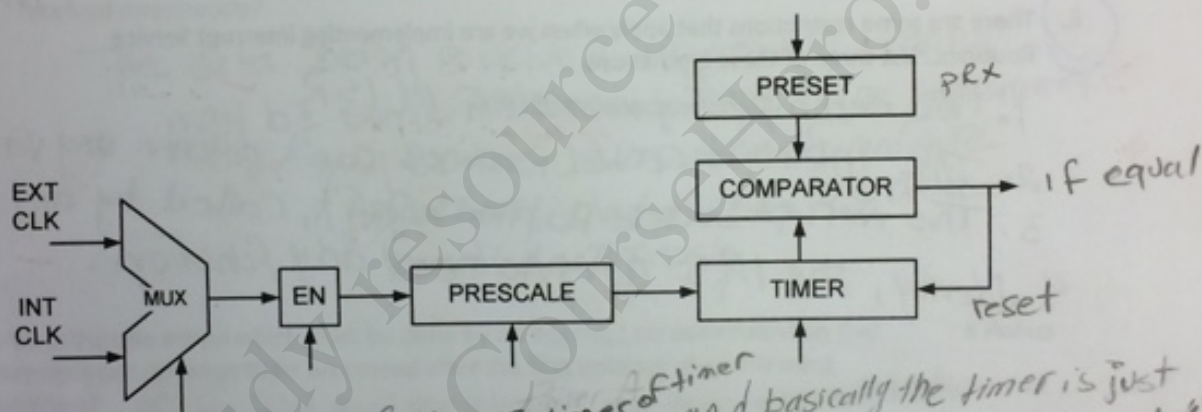**BONUS Question:**   **10 Points**

11. Given the conceptual block diagram below, explain in detail how a timer is
configured and how it operates.   7

PRESET — pRx

COMPARATOR — if equal

EXT CLK

INT CLK

MUX → EN → PRESCALE → TIMER — reset

We have two types of timers, times of timer, and basically the timer is just
a counter, when the counter in rasing edge its mean, it recived the data
and its wait until transmite the signal then, the counter will be
falling edge, then it would be read to transmite another bit and so one.

In the diagram
The counter control gets the one of these clock (external
or enternal) then it onnbe the counter register ✓
to prescale the clock by 1:1, 1:8, 1:64, 1:259
if the size of bit line is 16-bit.
and the we have to use timer A because its deal
with 16-data bits only. ✓
or if the data bit lines is 32-bit we have to use
timer B and that prescale as the following ✓
1:1, 1:2, 1:4, 1:8, 1:16, ... 1:259
and that timer combine two type of timer 2&3 timers
                                          4&5 timers
After prescale done the signal will compare it and
if its equal so the preset and go to the next
clock